January 30, 2006

Angela Reynolds, Environmental Planning Officer
City of Long Beach
Dept. of Planning & Building
333 Ocean, 7th Floor
Long Beach, CA 90802

Re: Comments on Long Beach Draft Environmental Impact Report

Dear Ms. Reynolds:

The purpose of this letter (and attachments) is to present the results of my review of the Long Beach Airport Terminal Area Improvement Project Draft Environmental Impact Report (DEIR), dated November 2005. The format of this letter is to present discussions related to areas of concern, followed at the end of each by a specific question that the DEIR should address.

Issue 1. Uncertainty Related to Aircraft Emission Factor Determination

Summary: The emission factors that are used in the dispersion model for aircraft emissions are based on inadequate test methods augmented by conservative assumptions. The result is highly uncertain and possibly biased results.

Discussion: The dispersion of airport emissions are modeled using the FAA EDMS model, which takes input on the emission factors from the various types of emission sources and models them using the current EPA AERMOD dispersion model. The accuracy of the output is dependent on the accuracy of the input. When one examines typical input parameters used in the modeling process, it appears to have significant potential for inaccuracy. In particular, the DEIR glossed over these limitations in its discussion of engine emission factors.

A review of the methods The methods used to produce the emission factor for the aircraft emissions are highly uncertain at best, and wholly inadequate at worse, based on several factors:

- EDMS does not have an extensive database of emission factors for aircraft. Most are estimated from the small data base of existing emission factors—six. The emission factor determination was likely performed many years ago, using older measurement technology as well as older engines. It is likely that this group of aircraft is not representative of the current fleet of aircraft.

- The determination is based on what is called a First Order Approximation. Some call this an "educated guess at an answer."[1] Following is the FAA description of the process (emphasis added):

[1] http://en.wikipedia.org/wiki/Zeroth_order_approximation

> "The Federal Aviation Administration's (FAA) first order approximation (FOA) methodology estimates PM emissions from commercial jet-turbine aircraft engines. The FOA serves an interim purpose of meeting PM compliance issues now, *while the science and accuracy of PM measurement techniques mature*. The non-volatile portion of PM is based on a correlation between the Smoke Number (SN) from the engine certification test and the fuel flow for a specific mode of operation, namely take-off, climb-out, taxi/idle, and approach. For some engines, a maximum SN is conservatively used because modal-specific SNs are not available. The volatile portion of PM is derived from a limited number of field measurements and theoretical relationships…."[2]

- The actual measurement of engine emissions is based on a very simple procedure called a 'smoke number.' This uses the reflectance of emission material (soot, organics, metals, etc.) collected on paper filters. However, this measurement is not directly related to the emissions of the engine. Following is the statement of research objectives by the FAA model development group:

  "The measurement methodology results in a smoke number which is not directly useable to determine the mass of emissions. Several approximate measures have been developed in an attempt to predict mass emissions using the smoke number, but *it is generally agreed that the results are not accurate*. The EPA maintains a minimal set of PM data for six, mostly older, aircraft."[3]

- Much of the emissions from aircraft and diesel engines is fine and ultrafine particulate matter—particles less than 1 micron in diameter. The measurement of these kind of emissions is currently an intensive area of on-going research. At a minimum, it is clear that the smoke number method that has been used does not represent the most current advances in measurement technology and likely does not accurate represent the actual emissions of aircraft, particularly as it relates to fine and ultrafine particles.[4]

- Finally, the EDMS system as been removed from EPA's list of preferred regulatory models because of a lack of appropriate validation studies and performance evaluation.[5]

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[2] http://www.volpe.dot.gov/air/publications.html.
[3] http://www.volpe.dot.gov/air/publications.html
[4] Air and Waste Management Association Conference, June, 2003. Roger L. Wayson et al. "Derivation of a First Order Approximation of Particulate Matter from Aircraft." Paper 69970.
[5] 40CFR 51, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Final Rule, November 9, 2005. http://www.epa.gov/scram001/guidance/guide/appw_05.pdf

Therefore, with the uncertain nature of the emission factors at the core of the modeling process, the predicted impact as determined by those models is highly uncertain. Other aspects of the model uncertainty are discussed below.

Issue #1 Question on DEIR: Given this information, how will the emission parameters be more accurately determined, and how will the revised dispersion estimates take these noted uncertainties into account?

2. Modeling Accuracy

Summary: The models used to predict the current and future emissions are highly uncertain, with decisions based on their output being about as uncertain as the models themselves, which is considerable.

Discussion: Many of the estimates produced by the DEIR for risk, emissions, and exposure are reported to two or three significant figures, suggesting a high degree of accuracy. In reality, the modeling upon which the results depend is highly uncertain.

Most estimates of model accuracy state that under good conditions (e.g., high quality input, ideal configuration, etc.) that they are accurate only to a factor of 2, and some other assessments suggest that single-event errors may range up to a factor of 10.[6]

The reasons for such a level of inaccuracy is due to the propagation of errors from the many inputs that are needed for the model. The models require several types of input, each of which has its own set of uncertainties:

1. Source emissions

Just one aspect of the uncertainty surrounding the emission sources was discussed above, however, similar discussions could be presented in terms of the emission factors used for many other sources. The emission factor collection used in modeling is a compilation of estimates from many sources, with not all data being of equal quality. Many source emission factors are estimates within themselves, so the uncertainty in those parameters gets propagated to other calculations down the line.

For example, an alternative approach to emission factors was presented by Petzold.[7] Using his emission factor of 84.1 grams of black carbon per take-off cycle to the current rate of 41 flights per day, or a total of 14, 965 flights per year yields a total of 1.3 tons of black carbon per year, or 2.4 tons of diesel particulate matter (see attached report for conversion factor). Assuming a conservative 25% of PM2.5 is elemental carbon and DPM, the net result is an emission of 9.5 tons per year—significantly higher than the 4.1 tons per year cited in the DEIR (page 3.2-25 of the AQ-HHRA).

[6] Milton Bechok, www.air-dispersion.com/feature.html

[7] Petzold A, Stroem J, Schroeder FP, Kaercher B (1999) Carbonaceous aerosol in jet engine exhaust: emission characteristics and implications for heterogeneous chemical reactions. *Atmospheric Environment* 33:2689-2698.

2. Meteorological Data

The DEIR states that airport data was used in the modeling. Detailed descriptions of the data collection methods for that data were not included in the text, but other descriptions of typical airport wind data collection does not fit the expected data quality for use in modeling. In particular, the EDMS and AERMOD models require detailed information on hourly wind conditions, including turbulence. Most airport wind data collection systems rely on only 2-3 minutes of data collection during any one hour.[8,9] Wind direction is collected on only a 10 degree resolution basis.[10] These aspects make the uncertainty in the computed results compared to actual conditions very high.

3. Dispersion coefficients

The dispersion coefficients are internal parameters related to how the emission plume spreads. These coefficients are generally fixed and in general have been derived in relation to a fixed emission point. In addition, they are related to particular types of stability classes. The extreme fluctuations in emissions from a dynamic (e.g. changing in position and emission rate) have not been considered. Indeed, even within a normal dispersion scenario, the ‘normal’ fluctuations in wind conditions has been cause for criticism of the standard models.[11] The use of this approach for highly dynamic airport emissions, both from aircraft and support equipment, suggests a great deal of uncertainty in the results.

4. Source Type.

The models allow various kinds of input types. For aircraft, their modeled emissions are based on being described as a volume source or an area source. Either method is a gross approximation of the actual configuration of the emission source. As with the other methods of estimation, the application of this kind of description introduces a great amount of uncertainty.

Question on DEIR: How will the modeling process address the balance between prudent conservatism and wholesale erroneous overestimation while maintaining a moderate level of accuracy? Furthermore, how will the modeled ambient concentrations reflect actual ambient conditions in the community?

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[8] http://www.wcc.nrcs.usda.gov/climate/windrose.html

[9] Richard H. Schulze, Improving The Accuracy Of Dispersion Models. http://www.environmental-expert.com/resulteacharticle4.asp?cid=3783&codi=5171

[10] Federal Meteorological Handbook No. 1 “Surface Weather Observations and Reports,” FCM-H1-1995, Washington, DC, 1995.

[11] Seibert, Petra, "Uncertainties in atmospheric dispersion modeling", Institute of Meteorology and Physics, University of Agricultural Sciences, Vienna, Proceedings Informal Workshop on Meteorological Modeling in Support of CTBT Verification, December 2000.

Issue 3. Ambient Diesel Exhaust Concentrations

Summary: The community exposure to diesel exhaust and aircraft emissions is currently a broad estimate. Given what is at stake, the modeled estimates should be backed up by measurement data on the current ambient air status.

Discussion: Given that 78% of the cancer risk is derived from diesel exhaust[12] it would be useful to put a larger amount of effort into understanding what risks the community is currently subjected to, and then what any increase in exposure would result in the event of increases in local emissions. The concentrations presented in the DEIR are based on estimates from other modeling, not measurement data. These data were modeled from emission rate data, much of which is old or recalculated based on many conservative assumptions.

The South Coast Air Quality Management District air monitoring station in North Long Beach does not allow the capture of airport related emissions. In particular, it does not include key parameters such as PM2.5, black carbon, or elemental carbon, which is used as a surrogate for diesel particulate matter (DPM).[13] These parameters are related to combustion processes. Competing sources in the area—major highways, ports, etc—have not been assessed relative to the contribution from the airport. Therefore, a complete examination of the risks to the community would include the assessment of the current state of exposure to key health-related parameters.

An initial examination of this exposure was recently conducted in the area surrounding the Long Beach airport and community. See Attachment. The findings showed that there is some potential for directly assessing the impact to the community from aircraft operations. It also showed that some areas of the city were experiencing higher than expected concentrations of DPM, with a subsequently higher health risk. Furthermore, the study showed that there were likely impacts from nearby industrial operations, namely the Ports of Long Beach and Los Angeles. These factors are not new, but the new data allows the start of the process to accurately determine the actual risk to the community instead of relying on modeling that may contain inaccuracies as discussed below.

<u>Question on DEIR: How will the City address the potential for increased risk to the community from increased airport operations given the initial disparities in the measured concentrations from the recent study and modeled concentrations?</u>

4. Presence of Ultrafine Particulate Matter

Recent research is showing the ultrafine particles contribute a much higher level of risk than their mass fraction in the overall aerosol burden.[14] While it not currently a regulatory requirement to include such an analysis, there is a growing scientific

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[12] CDM, Health Risk Analysis, Table 5.1, page 5-4.
[13] http://www.arb.ca.gov/qaweb/site.php?s_arb_code=70072
[14] Chow, Judy, et al. "Nanoparticles and the Environment,:" J. Air & Waste Manage. Assoc. 2005, 55, 1411-1417.

consensus that ultrafine particulate matter should be included in discussions of risk, particularly in urban centers. The DEIR discussion of particulate matter does not include sufficient assessment related to exposure to ultrafine particulate matter.

<u>Question on DEIR: Given that the DEIR has ignored the potential risks from ultrafine particulate matter, how will the plan be modified to address this risk to the community?</u>

Conclusions

Based on this review of the DEIR, it is my conclusion that although significant effort has been expended in producing the estimates of impact to the community from the various project scenarios, the combined uncertainty in the input to the models and the models themselves makes the conclusions highly uncertain. The quality of decisions made rests on the quality of the information to support that decision, and without the application of actual community data, the overall quality of the decisions is lacking.

Many of these concerns can be addressed through following a recommendation already made in an earlier air quality study. The 2005 Baseline Air Quality and Noise Human Health Risk Assessment recommended the collection of ambient air quality at potentially sensitive locations within Long Beach City limits.[15]

Thank you for your consideration of these comments to the DEIR.

Sincerely,

Eric D Winegar

Eric D Winegar, PhD, QEP
Principal, Applied Measurement Science

[15] MWH, Inc., "2005 Baseline Air Quality and Noise Human Health Risk Assessment,," page ES-8.

Summary Report

Community Ambient Air Monitoring: Black Carbon as a Surrogate for Diesel Exhaust Concentrations in Long Beach, California

Presented to:

California Earthcorps, Inc.
Long Beach, California

LBHUSH2
Long Beach, California

Prepared by:

Eric D Winegar, PhD, QEP
Applied Measurement Science
Fair Oaks, California

January 30, 2006

1. Introduction

The purpose of this report is to present the results of ambient air monitoring conducted around the city of Long Beach, California from September to December, 2005. The primary focus of this monitoring was the collection of black carbon concentrations in the atmosphere in the vicinity of the Long Beach airport and the surrounding community. Black carbon was used as a surrogate for diesel exhaust, or diesel particulate matter (DPM).

The objectives of this investigation were both practical and exploratory:

1. Determine the concentrations of DPM in the community surrounding the Long Beach airport;

2. Explore the potential for using real-time instrumentation for directly detecting the effects of aircraft take-offs to the community;

3. Assess the use of particulate matter-phase PAH (PM-PAH) as a surrogate for ultrafine particulate matter (UFM);

4. Explore the use of continuous instruments for assessing the source signature of detected DPM.

This work was conducted from September, 2005 to January, 2006. The set up and operation was primarily conducted by Eric D Winegar, PhD, principal of Applied Measurement Science, Fair Oaks, California. Assistance for the main phase and subsequent continuing monitoring was provided by Mr. Don May of Earthcorps and Mr. Randy Nisbet of HUSH2.

2. Technical Approach

A. Target Analyte: Black Carbon

Black carbon is the operationally defined parameter as measured optically at 880 nm using the Magee Scientific aethalometer instrument. Operationally defined means that the measured parameter is defined by the analytical process. There are several other operational definitions of carbon in the atmosphere, most of which provide results called ‘elemental’ carbon instead of black carbon. Black carbon and elemental carbon are related, as they both are subsets of the various carbon fractions that can be found in carbonaceous atmospheric aerosols.

Black and elemental carbon are related to diesel exhaust, as some fraction of diesel exhaust is comprised of carbon. DPM has no direct method for its determination because of the complex nature of the material, consisting of various emission products as well as lubricating oils and unburned fuel. However, several studies have determined the relationship between black and elemental carbon, and DPM.

B. Instrumentation.

<u>Aethalometer</u>: Magee Scientific AE-16 instrument. Collects air samples onto automated quartz fiber tape and detects the absorbed black carbon optically using lamps at 880 nm. At this wavelength, black carbon is the primary absorbing species. Black carbon is a surrogate for diesel

exhaust particulate, or diesel particulate matter (DPM). The aethalometer is the instrument of choice for the collection of real-time DPM samples.

PAS 2000. The EcoChem Photoelectric Aerosol Sensor (PAS) 2000 uses low-energy photoelectric absorption to detect PAH species adsorbed onto particulate matter (PM-PAH). Past work has shown it to be a sensitive detector for combustion species. Due to its high sensitivity optical sensing, it can collect highly time resolved measurements.

Wind speed and wind direction were obtained from the local 10 meter tower operated by the South Coast Air Quality Management District.

2.1 Data Collection Scheme

A. Time Resolved Measurements.

The technical approach to collection of the black carbon data was based on the ability of the aethalometer instrument to collect data on a continuous real-time basis. This would allow the detection of time-based events, which is essential because of the dynamic nature of the emission source (s). The aethalometer time base was 5 minutes, while PM-PAH was collected on a one-minute basis. The Cover Street aethalometer, nearest the airport, collected data on a one-minute basis.

B. Phased Sample Collection Periods.

First Phase: three aethalometers, PM- PAH. The time frame for the study was broken down into two segments. The first segment consisted of 28 days in which multiple instruments would be used to collect data at two or three locations along the flight path. Two instruments collected data for that entire period. In addition, a third instrument collected data at a simultaneous third location for approximately one week during this main initial phase.

Second Phase: two aethalometers. Following completion of the initial phase, the second phase was the collection of data at various background locations. During this phase, one of the initial locations continued data collection. The LaDera site data set consists of nearly the entire period from September 20 to December 21.

Secondly, the collection scheme was driven by the availability of instruments. One aethalometer was available for the duration of the initial monitoring phase and was placed at LaDera. The second was placed at Falcon for 28 days, and the third was available for 8 days at Cover Street. After the Cover Street data was collected, that instrument was moved around to the remaining background locations for the remainder of the study period. PM-PAH was collected at Falcon for the initial 28-day period.

C. Flight Information. Take-offs times for the main study period were obtained from airport staff.

2.2 Monitoring Locations and Time Periods

Two types of locations were chosen. One was a set of three locations along the take-off flight path from Runway 30 and are termed as source-impacted, meaning that they potentially are impacted by exhaust from the aircraft take-offs. The second set of locations were selected based on their siting in areas either upwind or cross-wind to the airport. These locations are shown in Figure 1.

Except for Cover Street and E. Patterson, which consisted of a van with battery power for the instrument, all the sites are residential neighborhoods. Care was taken to select locations without any localized diesel exhaust sources, including proximity to major highways or streets. Specific addresses are not include due for privacy reasons.

2.2.1 Source-Impacted Sites

Cover Street—located at the corner of Cover Street and Pixie Avenue
Falcon Avenue—residence midway in the block between E. Techachapi and E. Cartagena Streets.
LaDera Avenue—residence between E. Claiborne Drive and Cerritos Avenue.

2.2.2 Background Sites

East Patterson Street—in Signal Hill near sparse industrial and commercial areas. Van parked at community garden.
East Colorado Street—residential area
North Britton—residential area
Olive Street—residential area
LaLinda—residential area

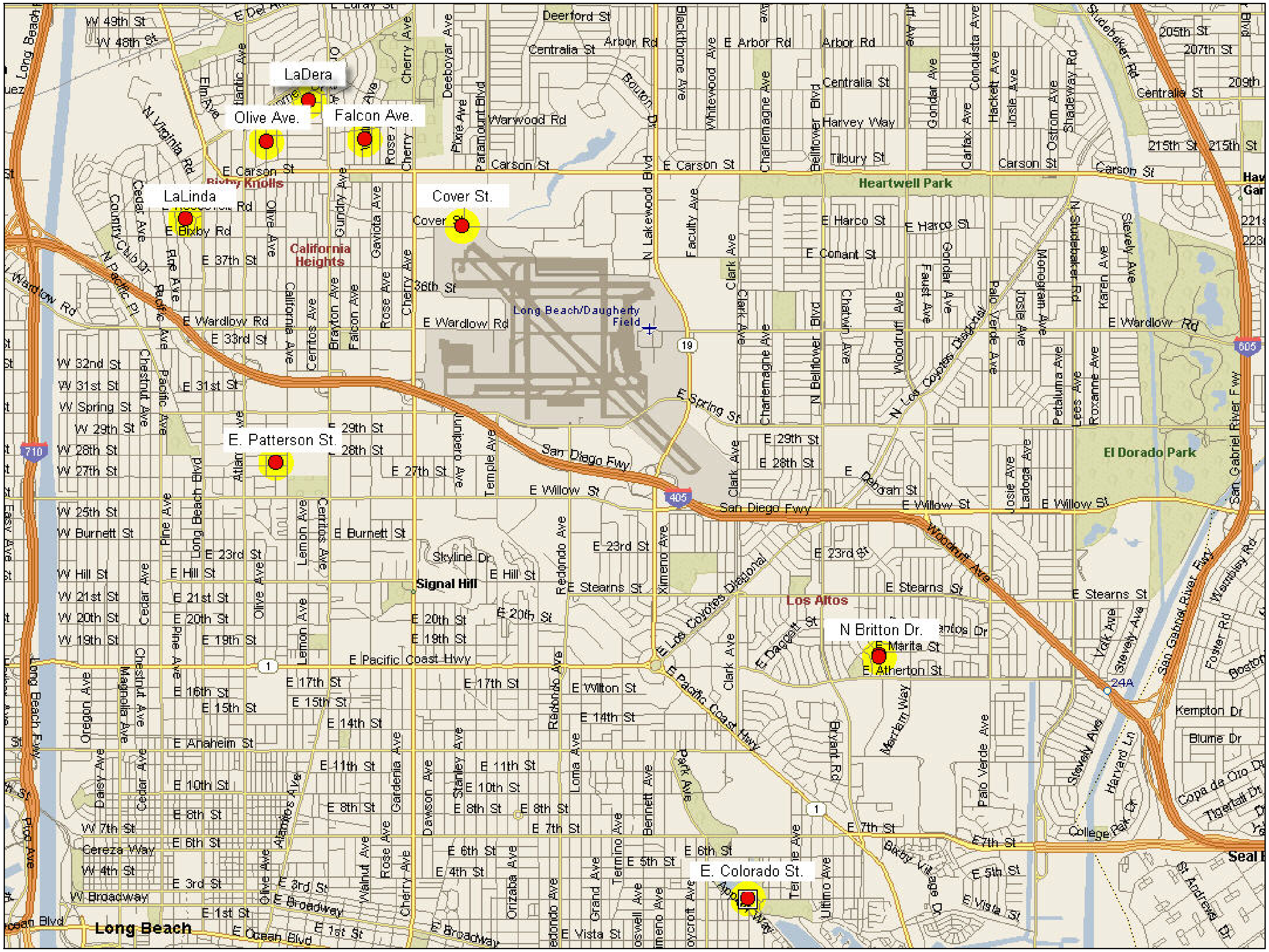

Figure 1. Monitoring Locations

3. RESULTS AND DISCUSSION

The time-resolved measurements were downloaded from each of the instruments, validated to remove anomalous points, and averaged to yield various sets of time frames. The one minute data was averaged into five minute periods so that the two parameters could be directly compared. Finally, all the data were averaged into one-hour values to conform to the usual format for continuous monitoring data. The time series data from the sites are presented below.

The value in time-resolved data is several fold:

1. Discern individual emission events
2. Examine peak concentrations
3. Obtain diurnal or other patterns over extended periods of time

For this data set, individual events were difficult to correlate with particular data points, but the time series and diurnal pattern data reduction can show useful information about trends in black carbon concentrations.

3.1 Time Series Data

3.1.1 Source-Impacted Sites

Figures 2 to 7 show the time series plots of the main source-impacted sites.
While the time series are useful in that they show the dynamic nature of ambient concentrations over time, it is difficult to discern overall trends. Individual events have less importance over time, as it is the longitudinal persistence of a pattern that has more significant effect compared to a specific short-duration event.

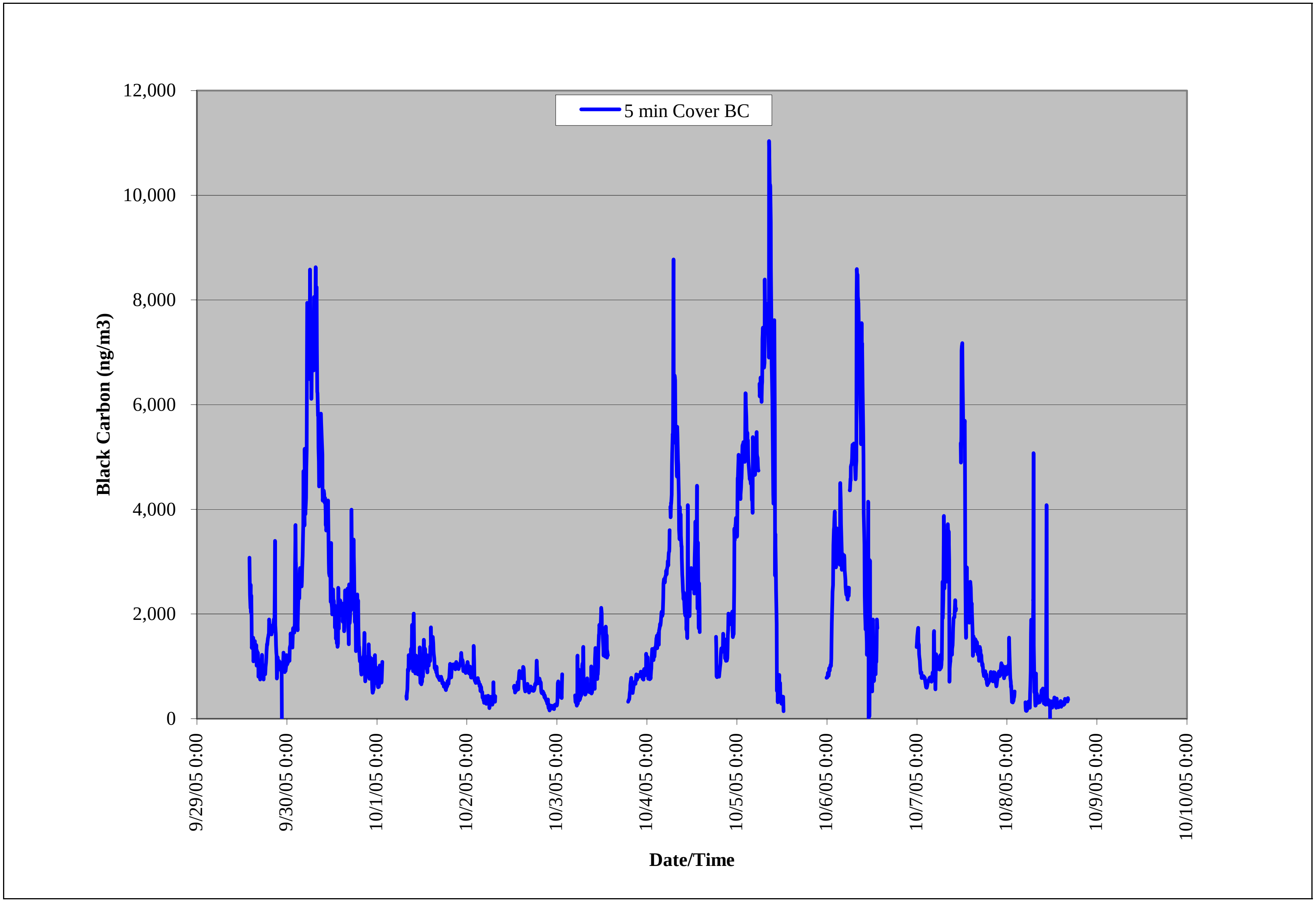

Figure 2. Cover Street BC Data

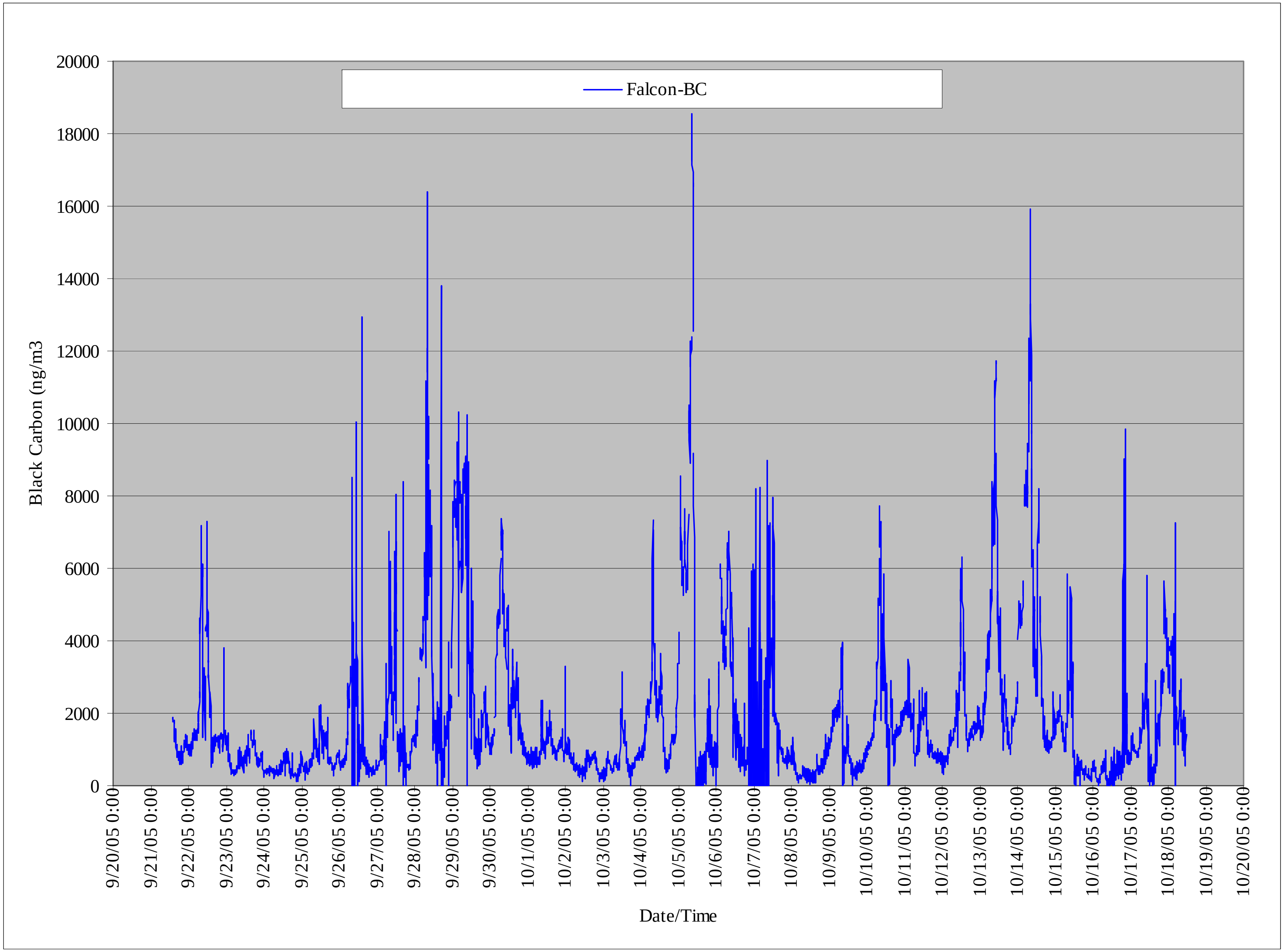

Figure 3. Falcon BC

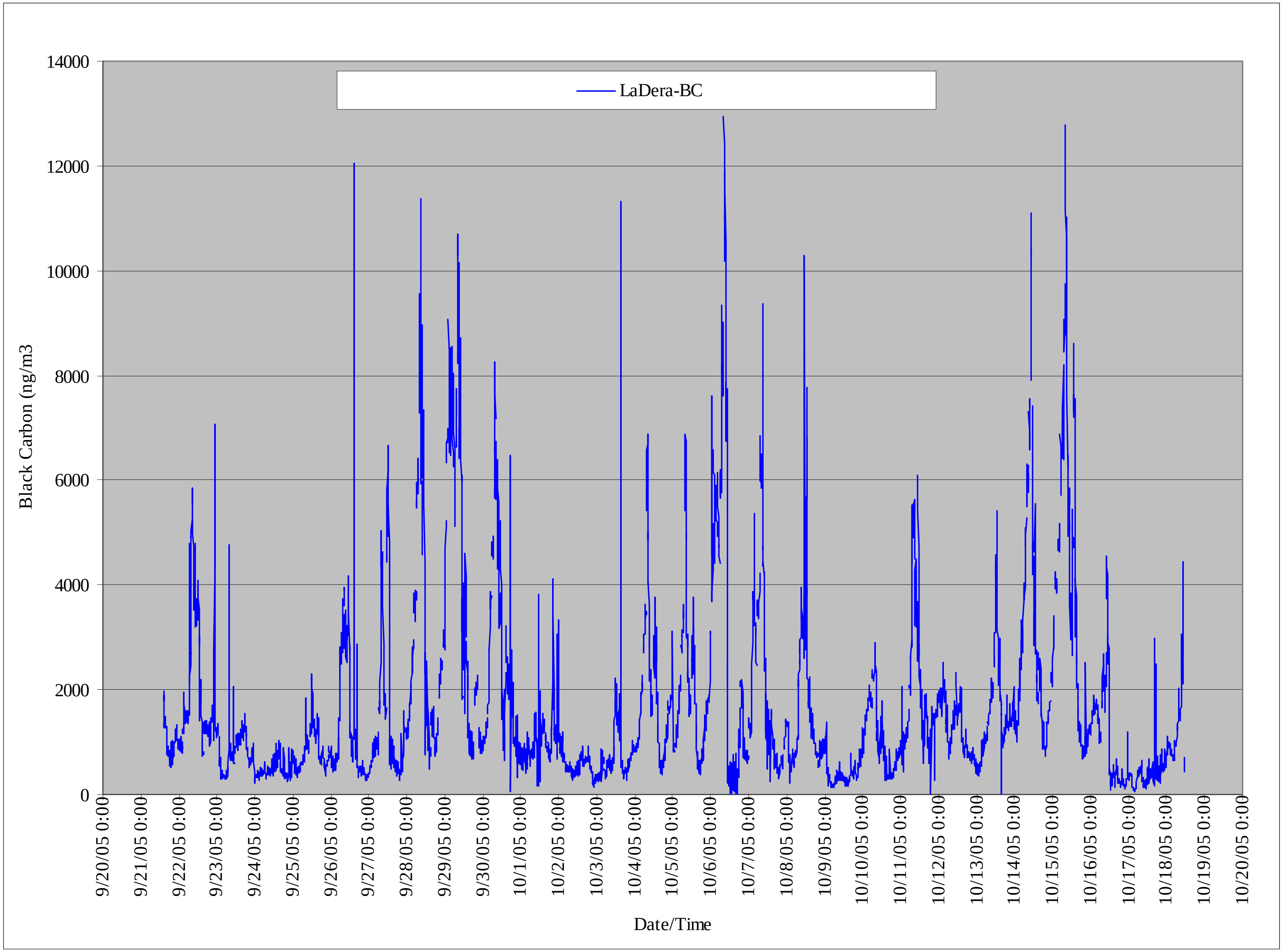

Figure 4. La Dera BC

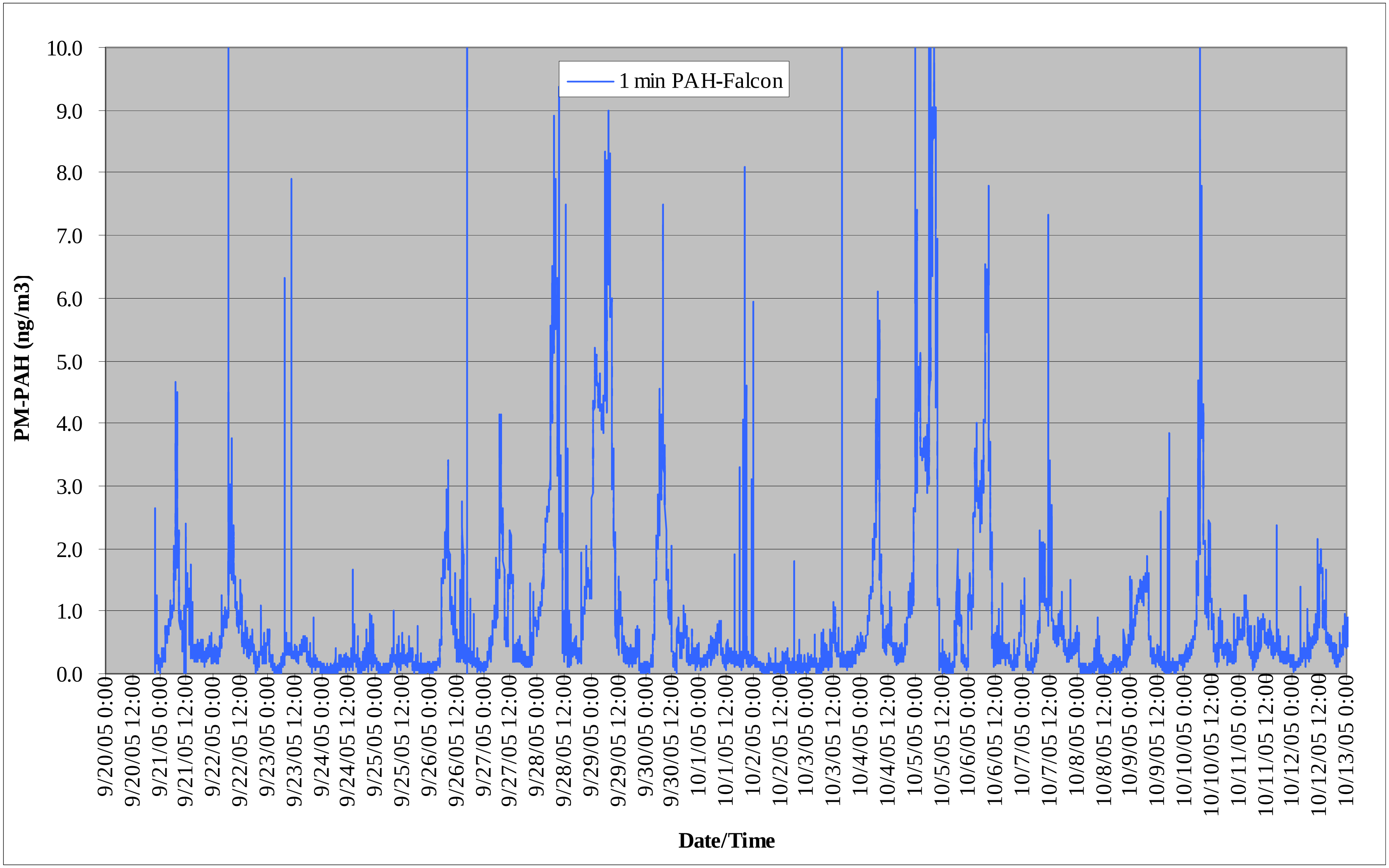

Figure 5. Falcon PM-PAH

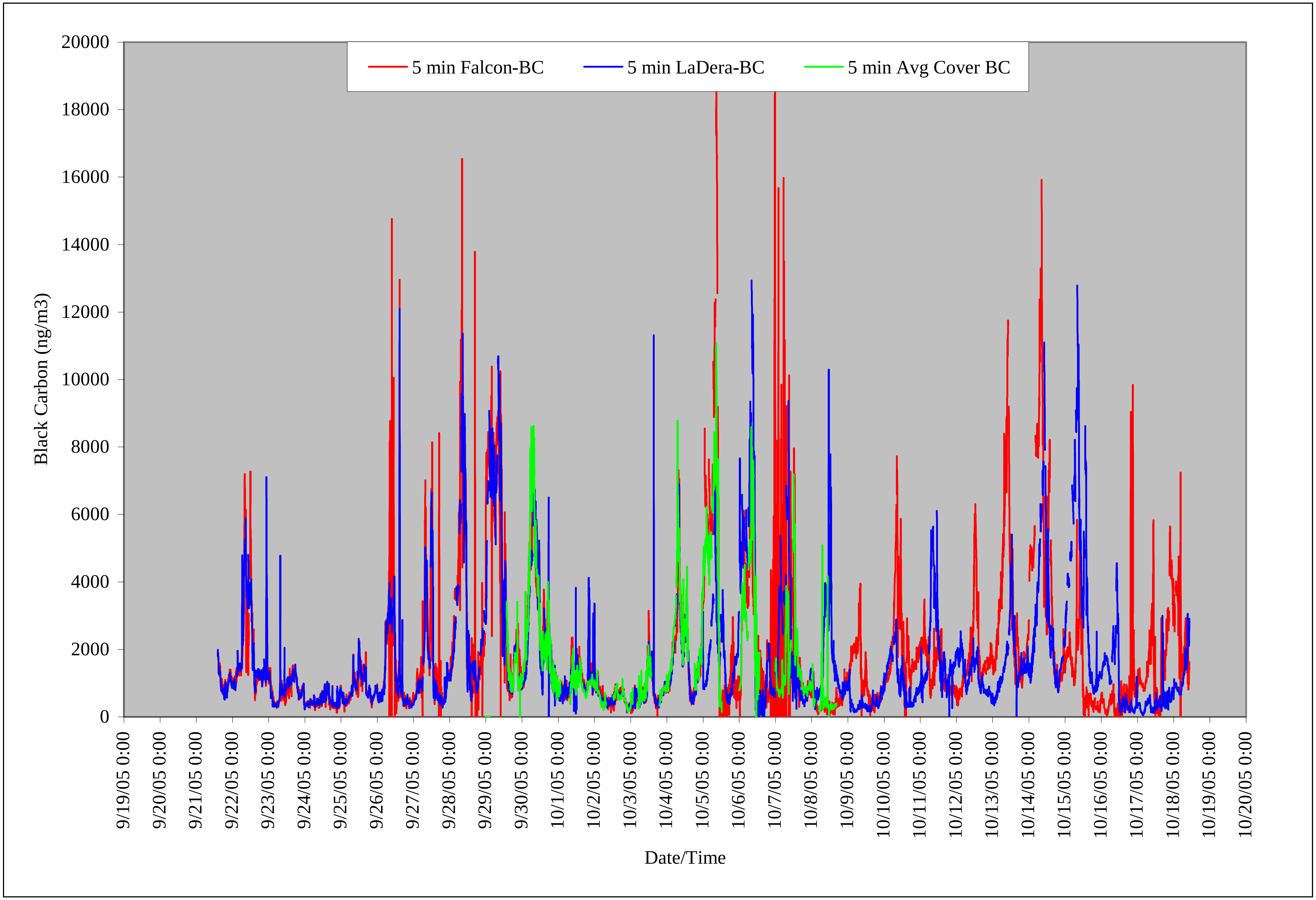

Figure 6. Cover, Falcon, LaDera Black Carbon

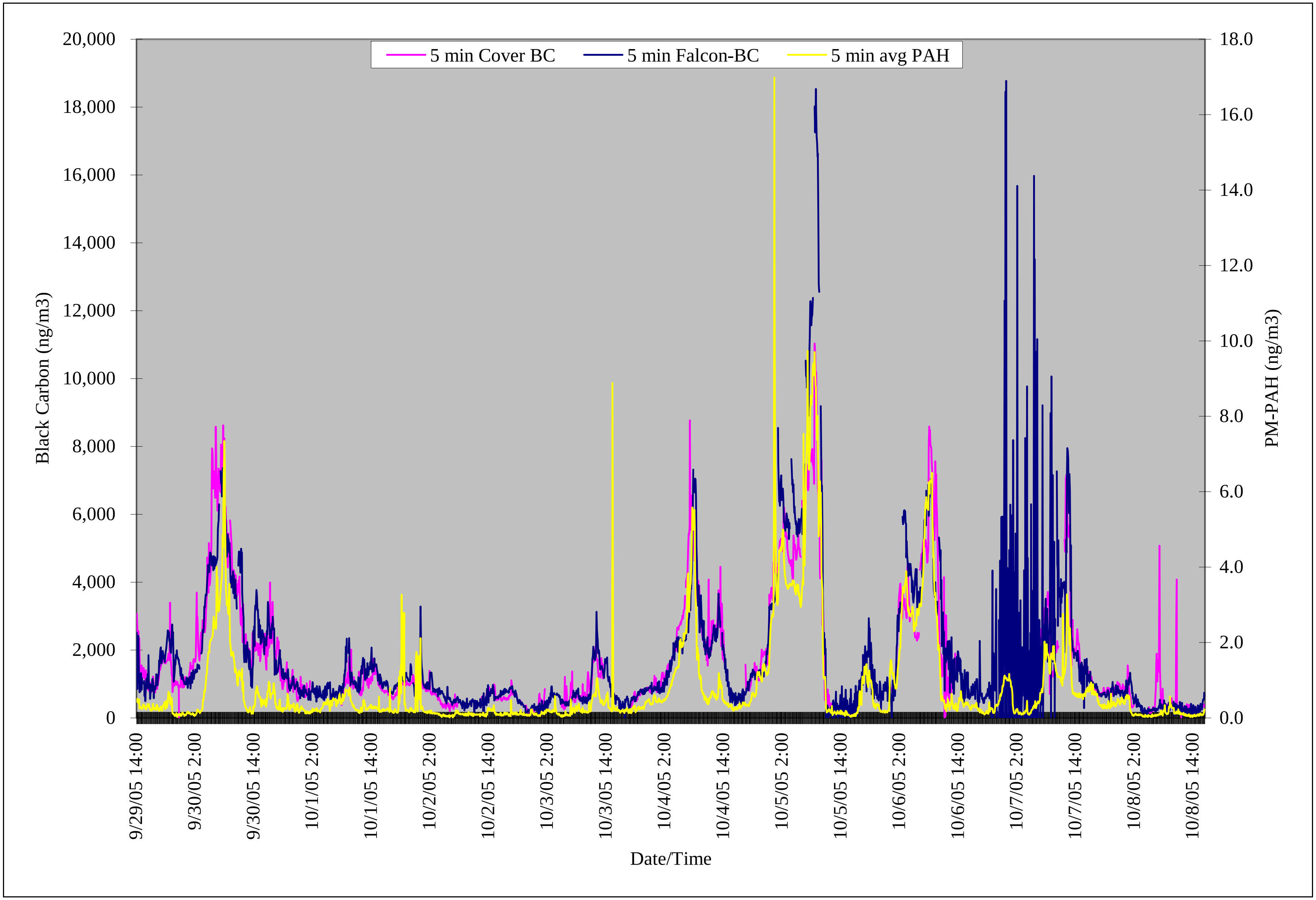

Figure 7. Cover Falcon Black Carbon and PM-PAH

3.1.2 Background Sites

Figures 8 to 12 show the hourly time-resolved concentrations for the background sites.

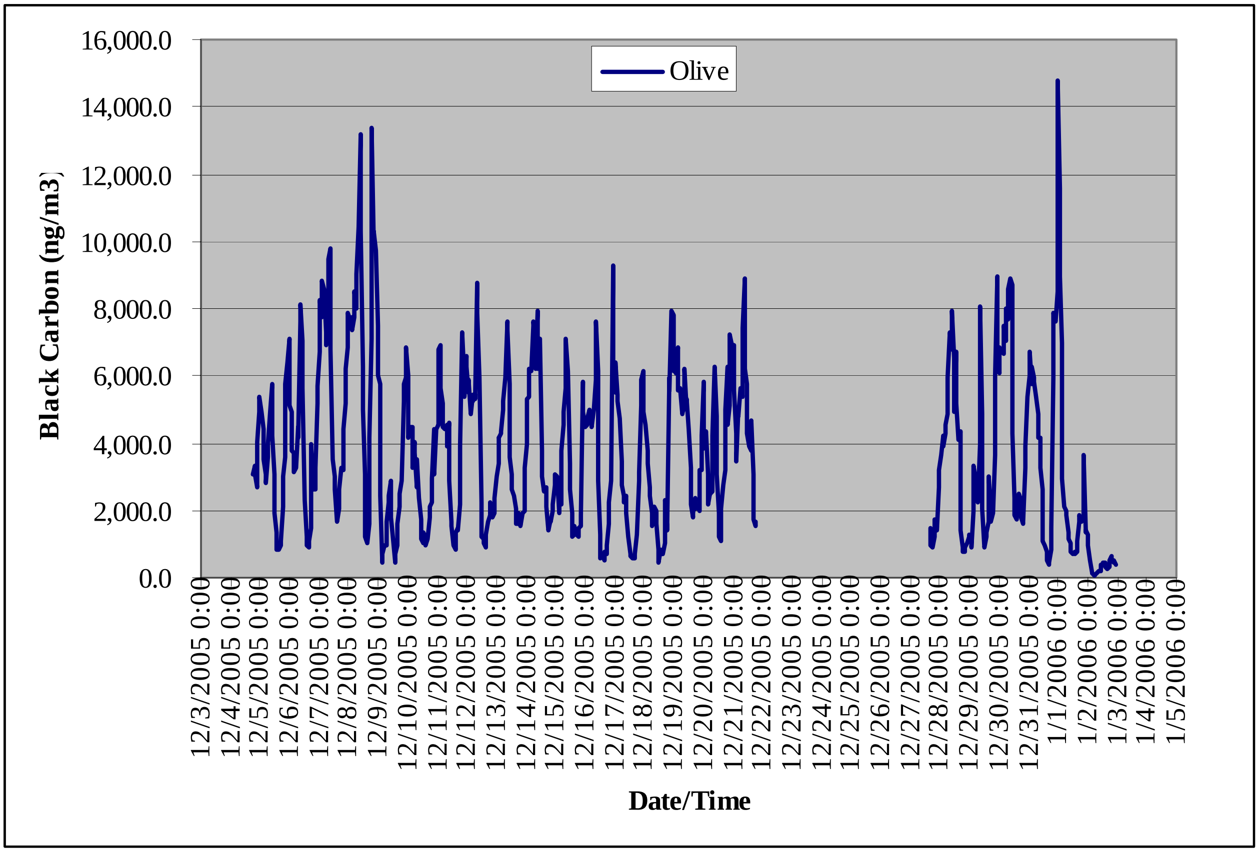

Figure 8. Olive Avenue

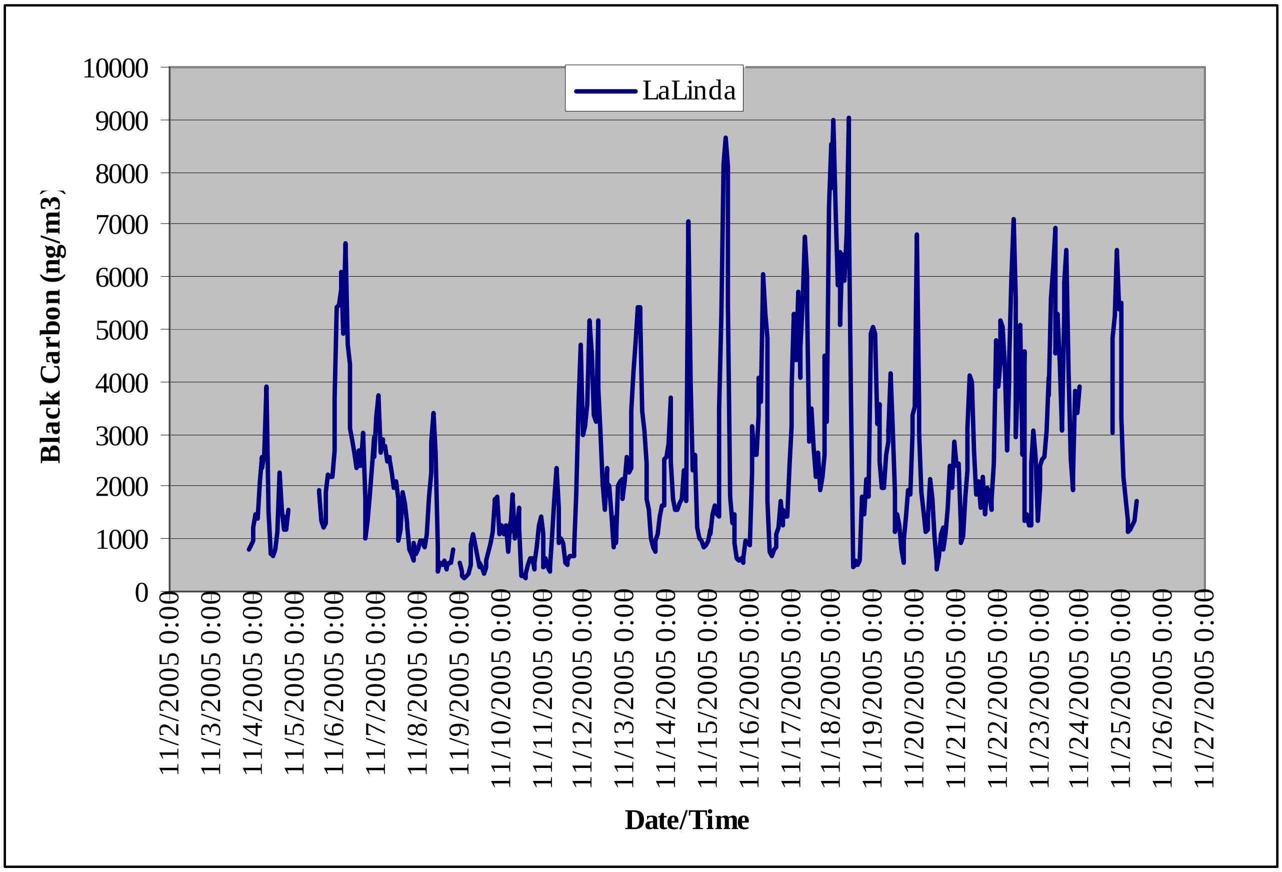

Figure 9. LaLinda Drive

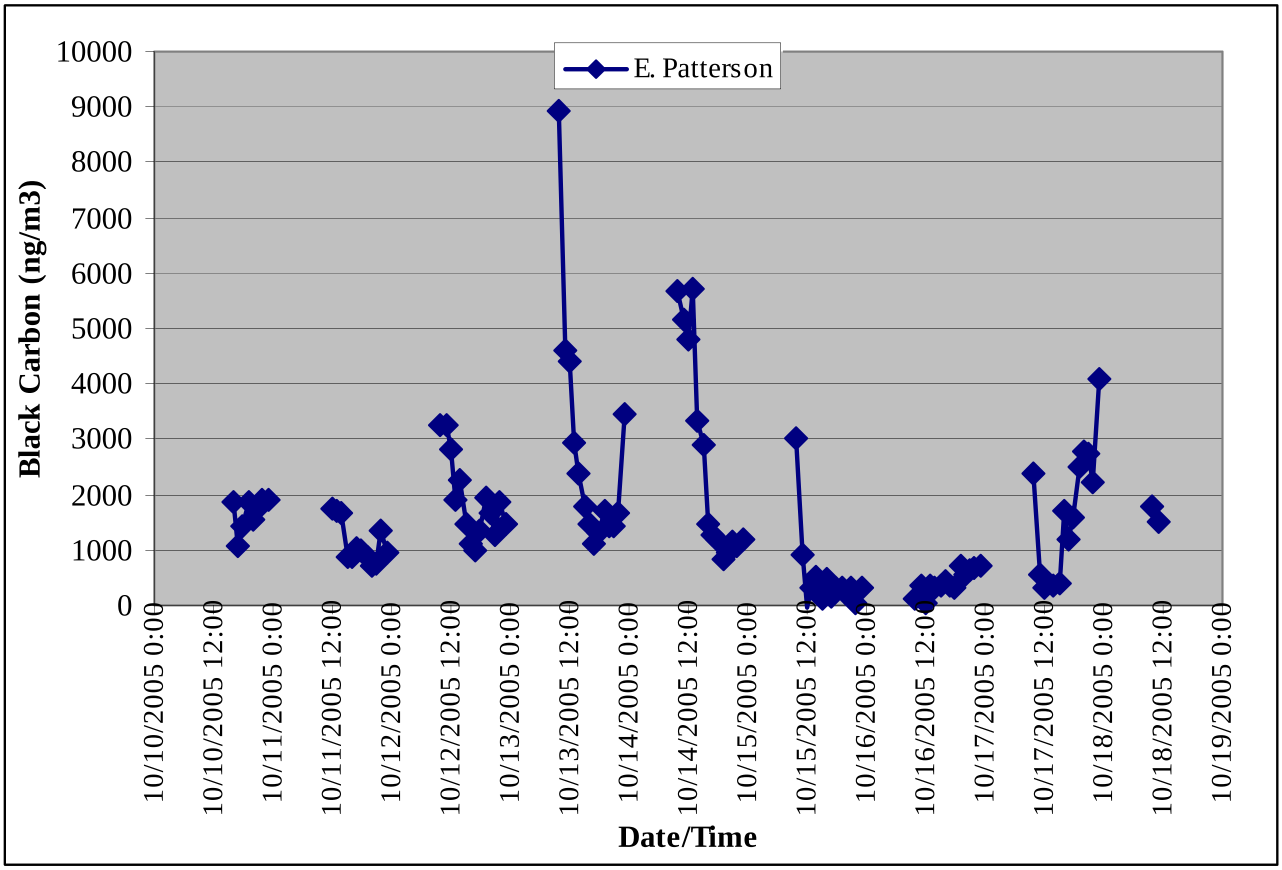

Figure 10. East Patterson Street

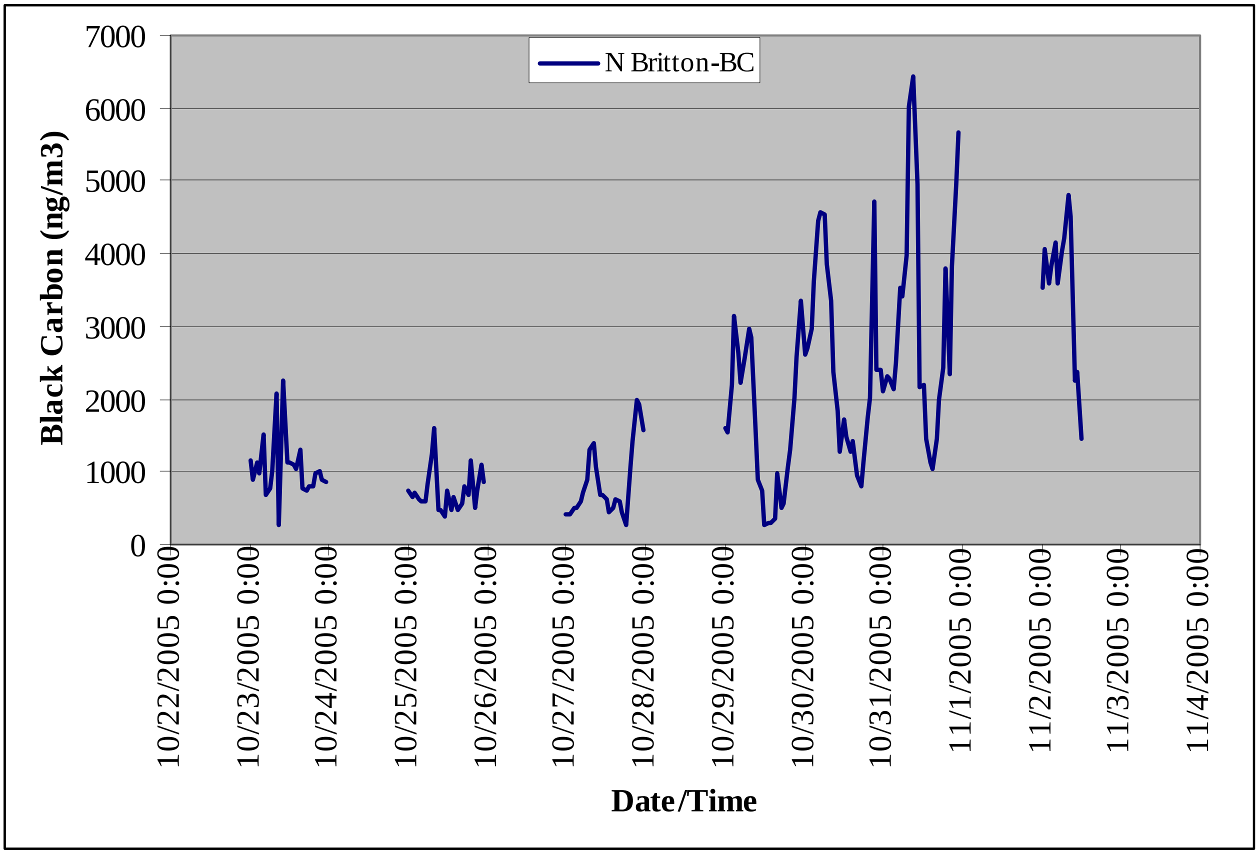

Figure 11. North Britton Drive

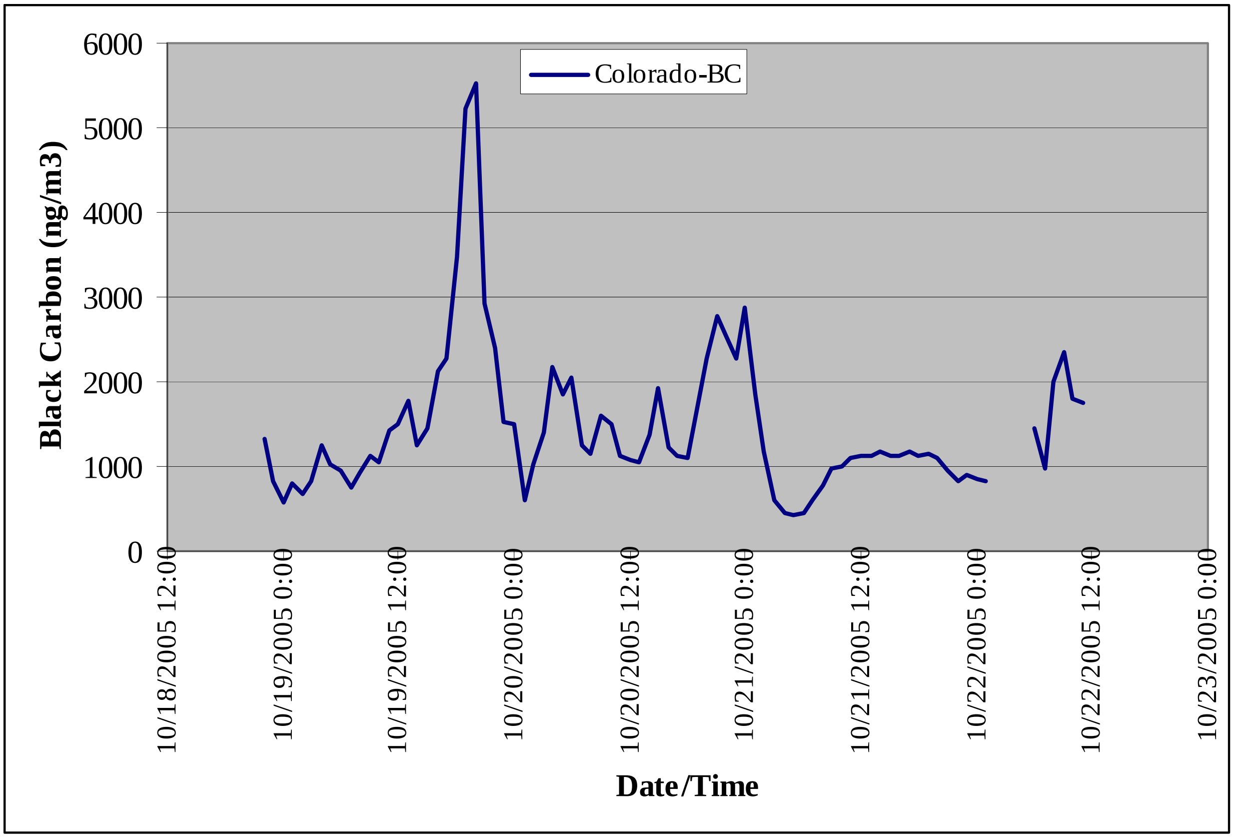

Figure 12. East Colorado Street

3.2 Diurnal Patterns

Figures 13 to 14 show diurnal patterns of the source-impacted and background locations. It is noteworthy that the background locations, particularly E. Patterson, differ from the source-impacted sites.

The background sites have significant noise associated with the trend due to the relatively short monitoring periods in each data set. Longer monitoring times would provide more data that can be averaged to smooth out short fluctuations.

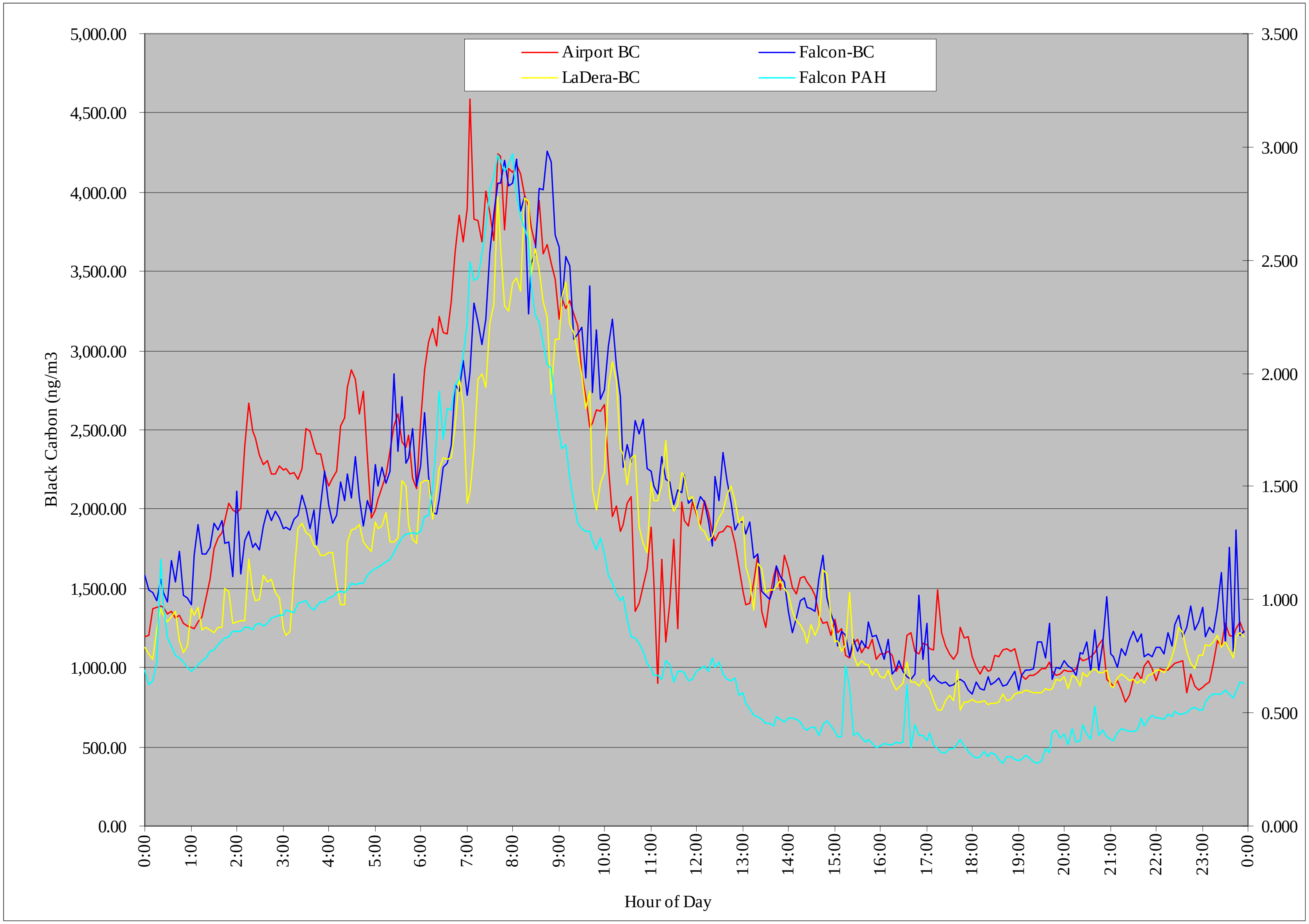

Figure 13. Diurnal Pattern, Source-Impacted Sites

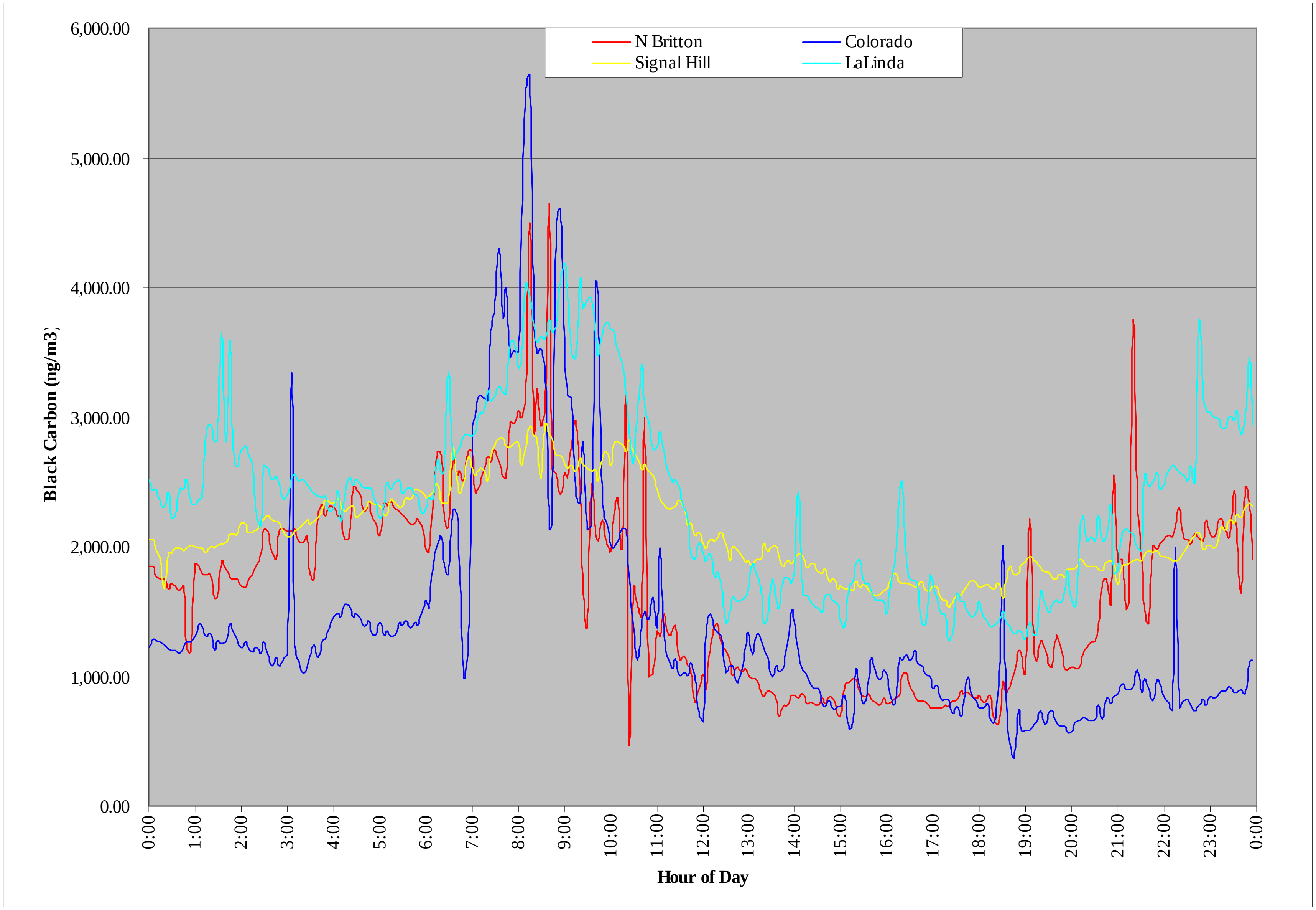

Figure 14. Diurnal Pattern—Background Sites

3.2.3 Diurnal Pattern Associated with Aircraft Take-Offs

Records of take-offs during the months of September and October were obtained from airport staff. A plot (Figure 15) of just the commercial flights compared against the measured black carbon and PM-PAH concentrations shows that some correlation at the Cover Street location can be seen.

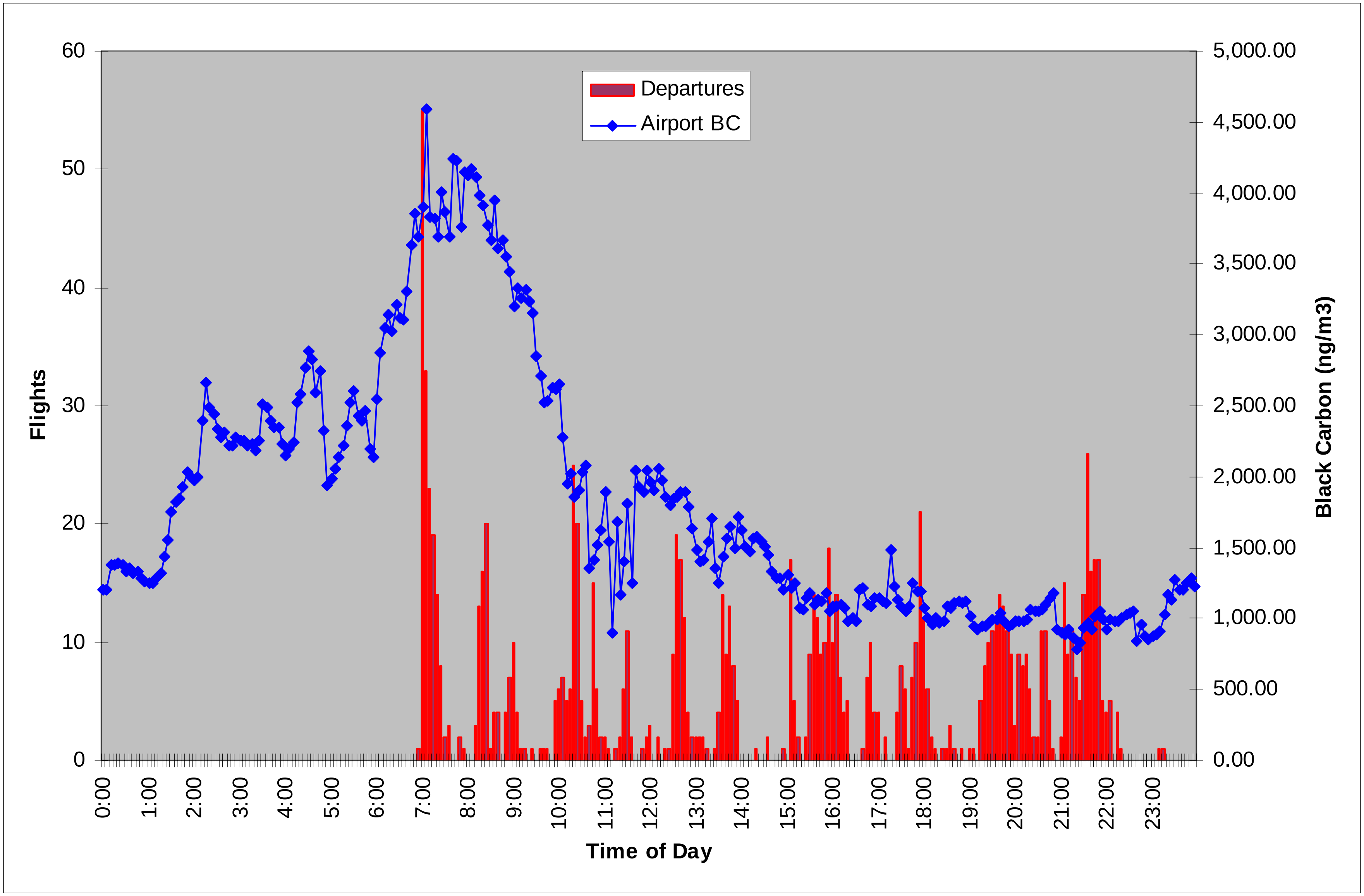

Figure 15. Correlation of Flights with Black Carbon

3.2.4 Traffic and Upper Air Patterns

Figure 16 shows the diurnal pattern of traffic. The morning peak is represented in the data as the early morning peak. The afternoon peak is washed out from the increase in the upper air boundary layer which enhances dispersion.

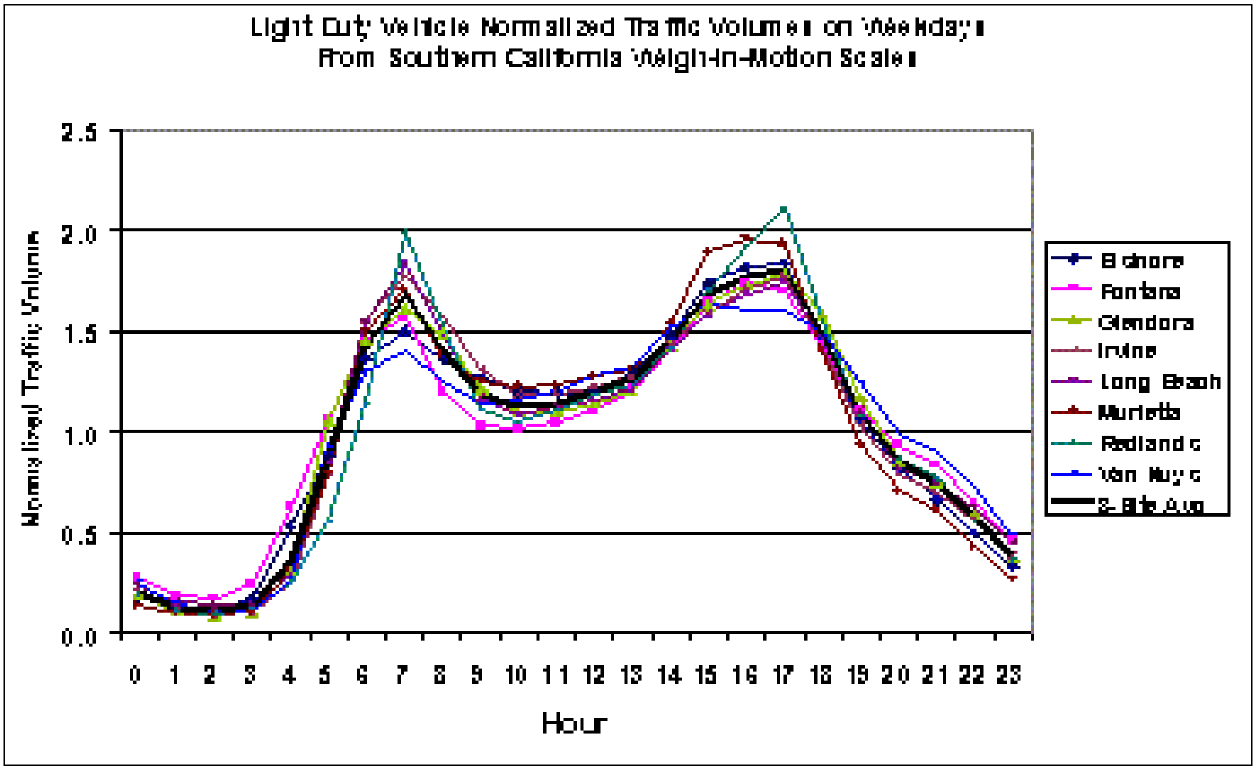

Figure 16. Diurnal Patterns of Traffic[1]

3.3 Meteorological Data

Due to instrument malfunction, the meteorological data was obtained from the South Coast AQMD North Long Beach monitoring station. This station is representative of area wind conditions as it is a 10 meter tower.

3.3.1 Wind Roses

Below are wind roses (Figures 17 to 20) for each month from September to December, 2005.

[1] Tami H. Funk and Frederick W. Lurmann, Sonoma Technology, Inc., Petaluma, CA "Using GIS to Investigate Children's Exposure to Air Pollution"

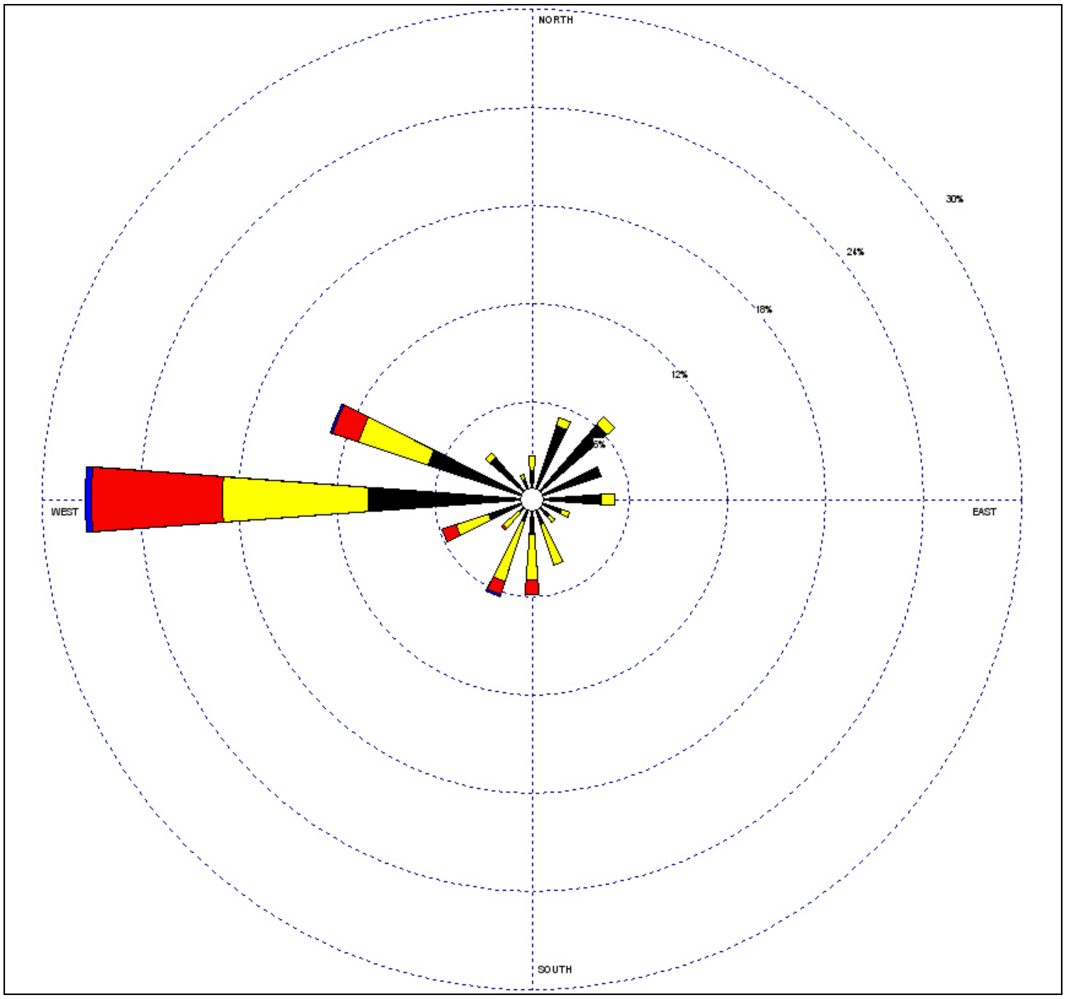

Figure 17. September Wind Rose

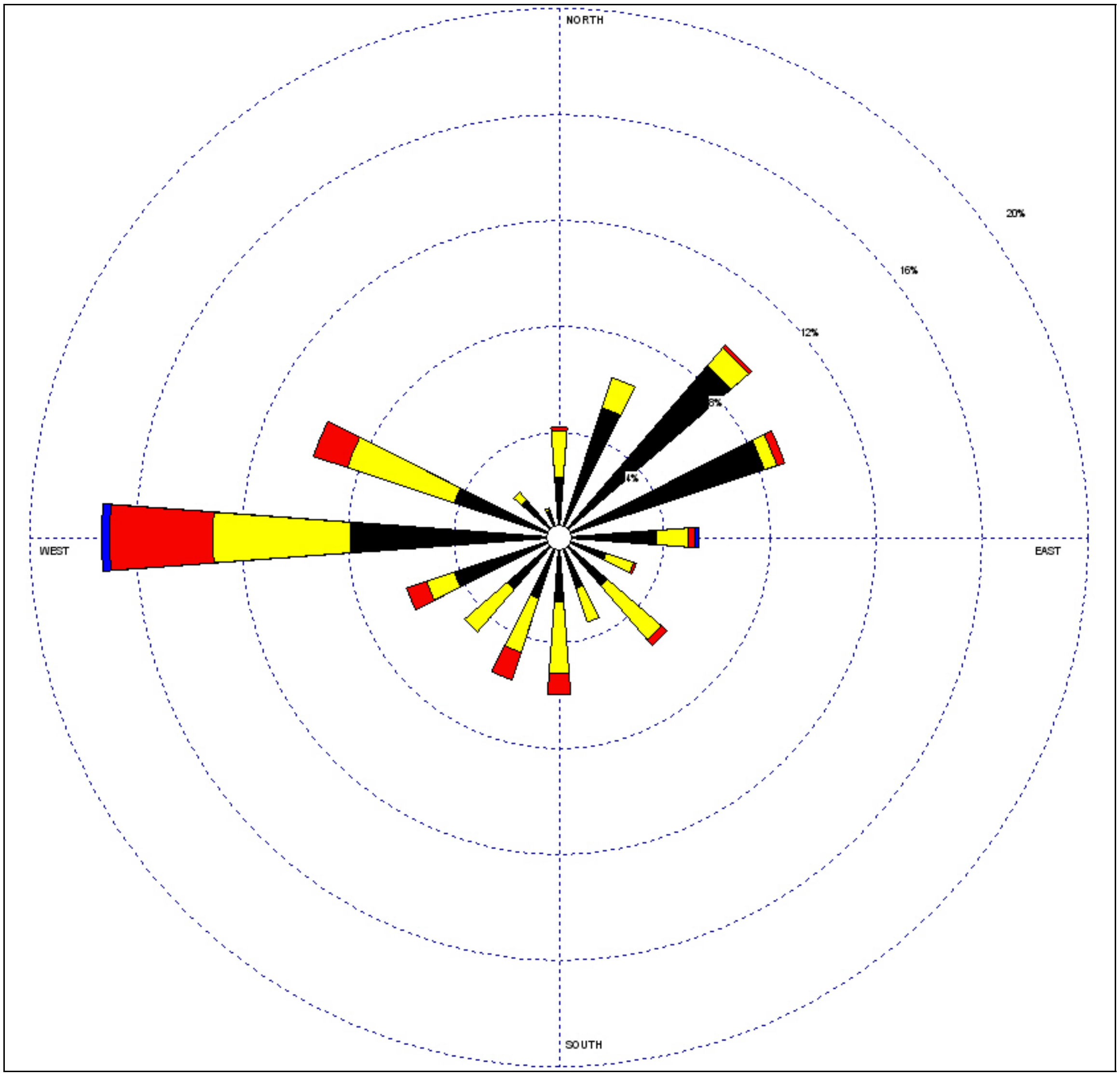

Figure 18. October Wind Rose

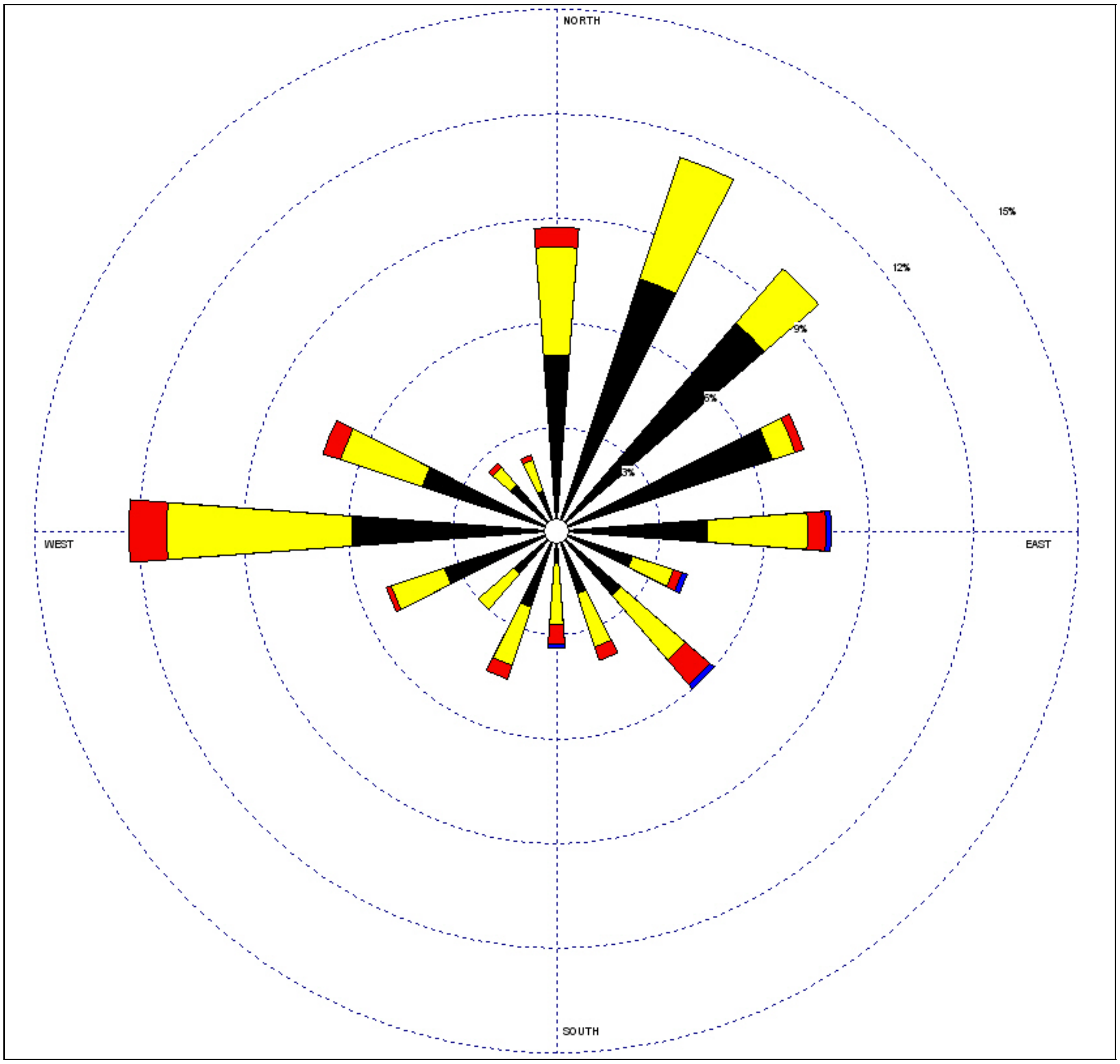

Figure 19. November Wind Rose

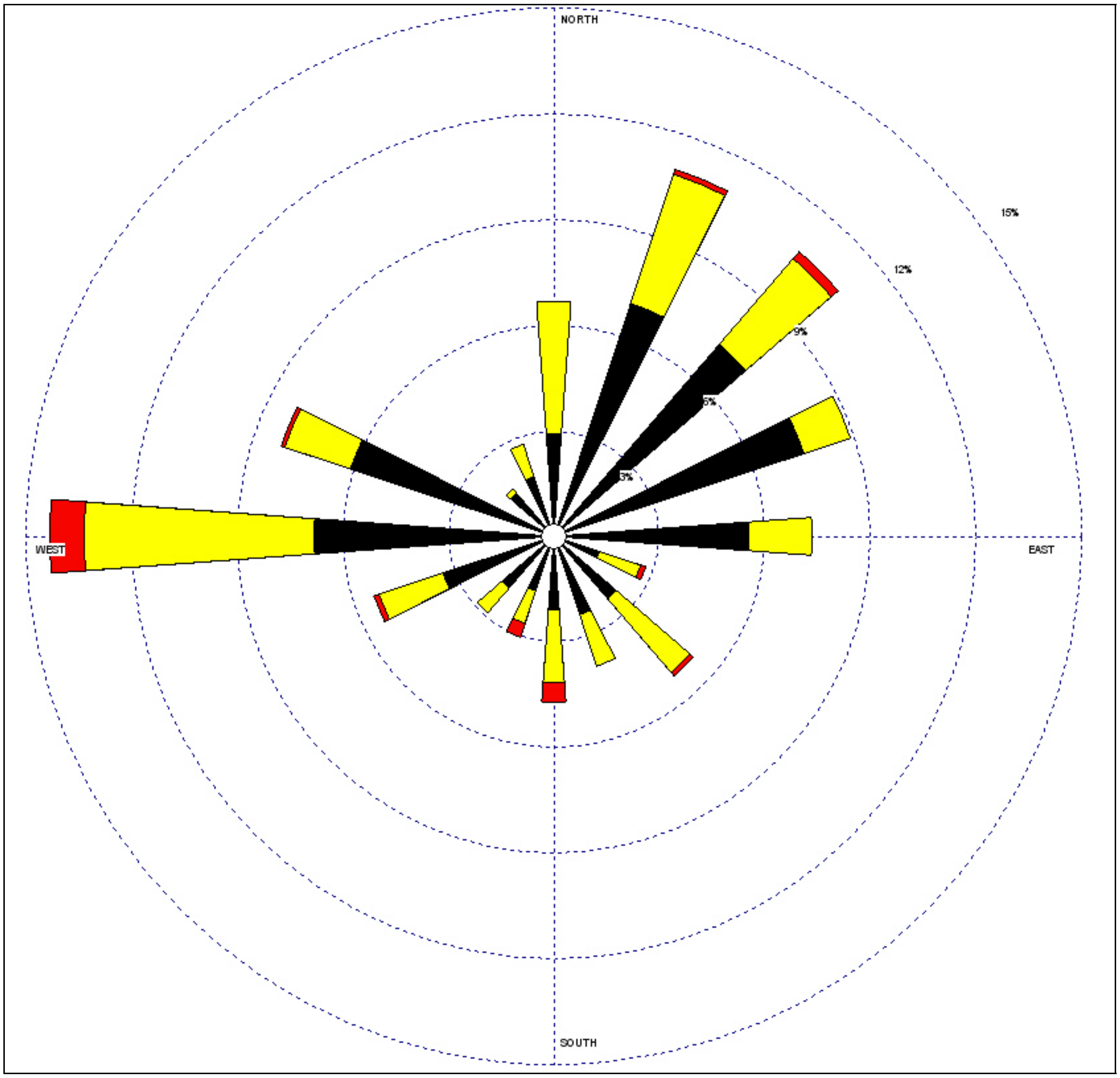

Figure 20. December Wind Rose

3.3.2 Diurnal Wind Pattern

Figures 21 and 22 show the diurnal pattern of the wind speed and wind direction. The morning hours facilitate the dispersion of airport emissions towards the community along the flight path, which is somewhat represented in the data, particularly the Cover Street data.

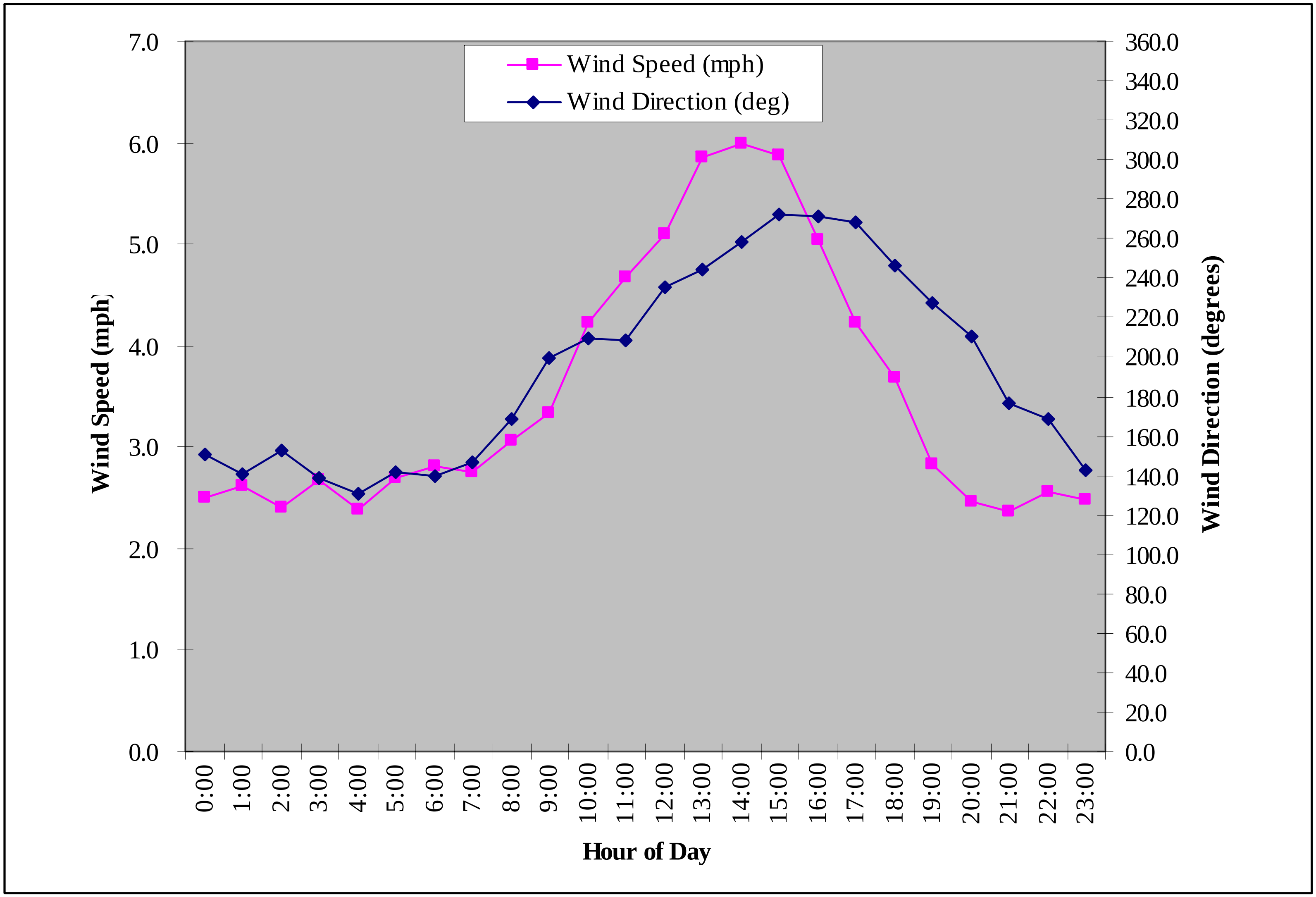

Figure 21. Diurnal Pattern—Wind Speed and Direction

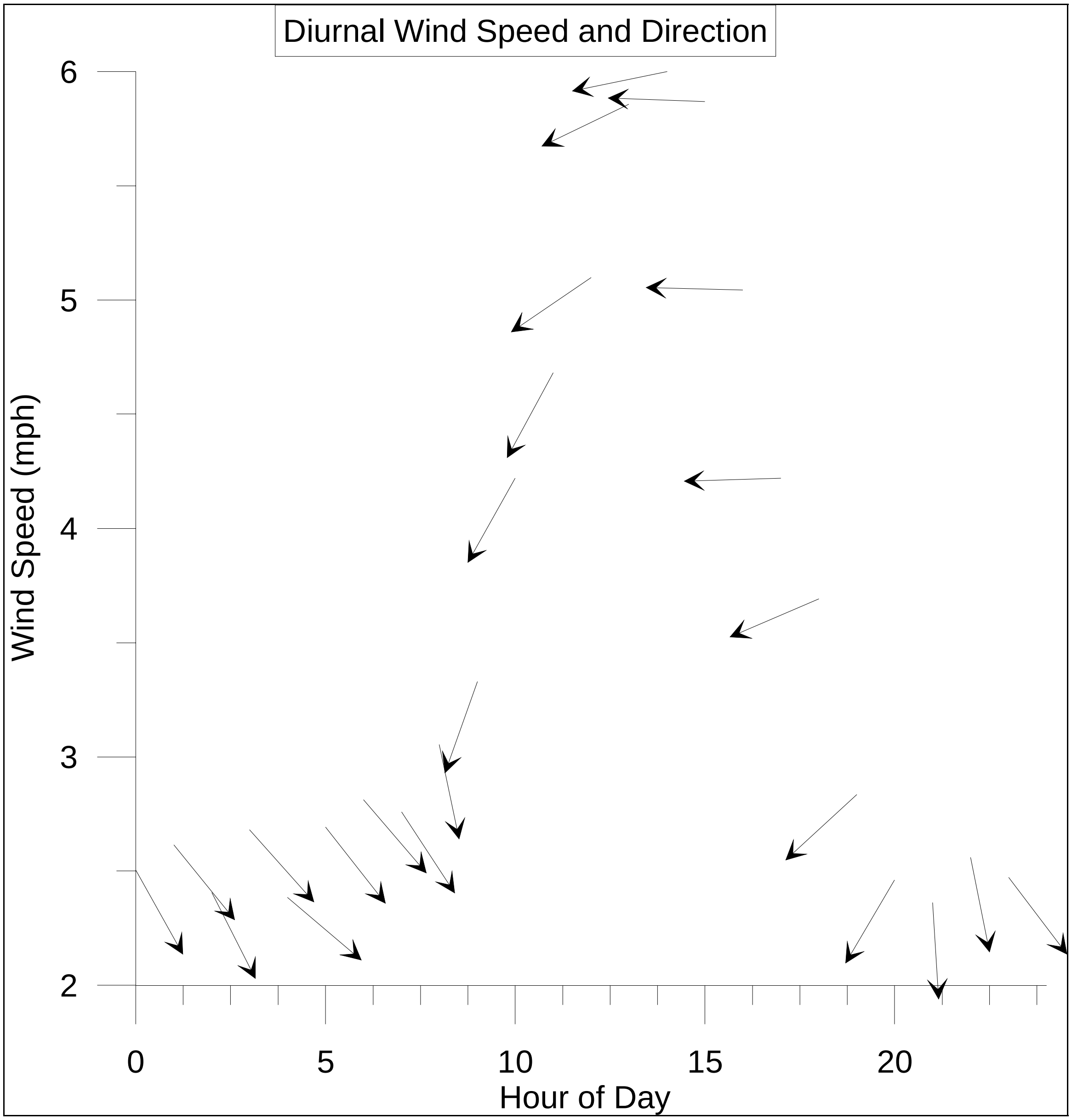

Figure 22. Alternate Diurnal Wind Speed and Direction Pattern
(North is UP, South is DOWN)

4. DIESEL PARTICULATE CONCENTRATIONS

As noted in the introduction, black carbon as measured by the aethalometer instrument is a subset of all the carbon material in a particular kind of aerosol. Therefore, black carbon must be converted to diesel particulate matter concentrations through the use of correlations and other factors. Unfortunately, the conversion process is not straightforward, as there is no set factor that is universally agreed upon. Much of this is due to the state of understanding regarding the fraction of diesel exhaust that can be assigned to elemental carbon.

It is beyond the scope of this work to assess each conversion factor and make a selection of which is most appropriate. Therefore, two conversion factors will be used here that represent conservative upper and lower bounds for the calculation of ambient DPM. These factors are based on the work presented in Fruin et al.[2] The range of factor goes from 1.8 times BC to 5.6 times BC.

Using these factors, the average DPM concentrations at the study locations are contained in Table 1.

Table 1. Summary of Black Carbon and DPM Concentrations

	BC	**DPM Low Factor (1.8)**	**DPM High Factor (5.6)**
Site	**(ug/m3)**	**(ug/m3)**	**(ug/m3)**
Cover	1.92	3.5	10.8
Falcon	1.66	3.0	9.3
LaDera	2.61	4.7	14.6
Olive	3.71	6.7	20.8
LaLinda	2.43	4.4	13.6
E. Patterson	1.59	2.9	8.9
N Britton	1.80	3.2	10.1
Colorado	1.46	2.6	8.2
Grand Avg	**2.15**	**3.87**	**12.03**

Comparison with other locations is useful. A study of six locations across the US yielded an average BC concentration of 1.49 $\mu g/m^3$. The average obtained here is 44% higher than this value. The Fruin reference shows that the ambient concentration of DPM (using the low conversion factor) in high congestion areas of Los Angeles was 2.4 $\mu g/m^3$. The average DPM determined here is 61% higher than this low estimate.

These data suggest that additional monitoring to understand the distribution and magnitude of the DPM in the community is warranted.

[2] Fruin, Scott, Arthur Winer, Charles Rodes, "Black Carbon Concentrations in California vehicles and estimation of in-vehicle diesel particulate matter exposures," Atm. Env. 2004, 38, 4123-4133.

5. CONCLUSIONS

Monitoring has been conducted at several locations over a period of several months in order to ascertain the black carbon (as surrogate for DPM) concentrations surrounding the Long Beach air port.   Time series data as well as diurnal patterns were assessed at each of the eight sites. The resulting BC and converted DPM concentrations are higher than other sites and estimates of the area DPM concentration.

Using time-resolved data collection, attempts were made to correlate the take-off from runway 30 with detections of black carbon and/or PM-PAH along the flight path.   Some success was seen, but additional data collection will be necessary in order to fully exploit this potential tool.

The use of the PM-PAH sensor was shown to be useful in that it correlated well with black carbon. Its higher sensitivity (a factor 100 greater than the aethalometer) may allow it to detect specific events with more precision. In addition, this and other work suggest that it may be useful as a surrogate for ultrafine particulate matter, a category of aerosol is seeing increasing attention due to its health impact.

The time-dependence of the continuous instruments was shown to yield useful information relating to daily patterns. Comparison with traffic and other dispersion parameters such as upper air trends will assist in understanding the impact from other sources such as the Ports of Los Angeles and Long Beach as well as the major highways in the area.

This work suggests that the community would benefit from further information on the origin and distribution of black carbon/DPM in their area.